London, 1888," by the Rev. A. Irving, D.Sc. Lond., Senior Science Master at Wellington College. The same publishers have in preparation seven new volumes of their "Elementary Science Manuals."

THE Smithsonian Institution has published a new edition of Mr. Frank Wigglesworth Clarke's "Tables of Specific Gravity for Solids and Liquids." It is, in effect, a new edition of Part I. of the work called "The Constants of Nature." The tables in this "part" have been revised, rearranged, and as nearly as possible brought up to date. The work is issued in England by Messrs. Macmillan and Co.

THE Abbé Armand David, whose writings on the natural history of China are well known in France, is contributing a series of articles to *Les Missions Catholiques* of Lyons on the fauna of China. In the last issue of that journal he completed the papers on Carnivora.

THE *Publishers' Circular* states that a work entitled "The Ice Age of North America, and its Bearings on the Antiquity of Man," by Prof. G. F. Wright, is announced for early publication by Messrs. Appleton and Co., of New York. It will be amply illustrated from photographs taken by various members of the United States Geological Survey during the past ten years.

A WORK on the Island of Saghalin and its vertebrate fauna, by Dr. Nikolsky, has just been published. The author, a native of Astrakhan, is well acquainted with the fauna of the Altai and West Turkestan, and is known as the writer of an interesting work on the fauna of Lake Balkhash. In his new book he has utilized, besides his own collections, the very rich collections formed by the late M. Polakoff.

MR. W. P. COLLINS has issued a catalogue of works on *Cryptogamia.* He claims to possess a more complete set of books on Diatoms than have ever been advertised in a bookseller's catalogue.

WE have received vol. iii., Part 4 (second series), of the Proceedings of the Linnean Society of New South Wales. It contains the following papers:—Revision of the genus *Heteronyx*, with descriptions of new species, Part 1, by the Rev. T. Blackburn; Diptera of Australia—Part 4, the Simulidæ and Bibionidæ, by Frederick A. A. Skuse (Plate xxxix.); further notes on Australian Coleoptera, with descriptions of new genera and species, by the Rev. T. Blackburn; contributions towards a knowledge of the Coleoptera of Australia—No. 5, on certain species belonging to unrecorded genera, by A. Sidney Olliff; descriptions of hitherto undescribed Australian Lepidoptera (Rhopalocera), by W. H. Miskin; notes on Australian earthworms, Part 5, by J. J. Fletcher; descriptions of Australian Micro-Lepidoptera—Part 15, Œcophoridæ (continued), by E. Meyrick; on simple striated muscular fibres, by W. A. Haswell; jottings from the Biological Laboratory of Sydney University, by W. A. Haswell; Diptera of Australia—Part 5, the Culicidæ, by Frederick A. A. Skuse (Plate xl.); list of the Australian Palæichthyes, with notes on their synonymy and distribution, Part 1, by J. Douglas Ogilby; a list of the birds found in the county of Cumberland, N.S.W., by A. J. North.

THE additions to the Zoological Society's Gardens during the past week include a Grey Ichneumon (*Herpestes griseus*) from India, presented by Mrs. Walter Boden; a Serval (*Felis serval* ♂) from Zambesi, presented by Mr. John Walker; an Ocelet (*Felis pardalis* ♂) from America, a Red Brocket (*Cariacus rufus*), two White-eared Conures (*Conurus leucotis*) from Brazil, an Acouchy (*Dasyprocta acouchy*) from British Guiana, a Brazilian Tree-Porcupine (*Sphingurus prehensilis*), a Blue-fronted Amazon (*Chrysotis æstiva*), a Yellow Hangnest (*Cassicus persicus*) from South America, a Hairy Armadillo (*Dasypus villosus*), a Pileated Jay (*Cyanocorax pileatus*) from La Plata, presented by Mrs. Wolfe; a Diana Monkey (*Cercopithecus diana*, var. *ignita* ♀), a Campbell's Monkey (*Cercopithecus campbelli* ♂) from West Africa, a Musanga Paradoxure (*Paradoxurus musanga*) from the Indian Archipelago, presented by Colonel Wethered; a Nightingale (*Daulias luscinia*), British, presented by Mr. John Young; a Bar-tailed Pheasant (*Phasianus reevesi*) from North China, presented by Mr. Charles J. Lucas; a Yellow-headed Conure (*Conure jendaya*) from South-East Brazil, a Blue-and-Yellow Macaw (*Ara ararauna*), a Blue-fronted Amazon (*Chrysotis æstiva*) from South America, deposited; an American Jabiru (*Mycteria americana*) from Para, an American Tantalus (*Tantalus loculator*) from America, purchased.

OUR ASTRONOMICAL COLUMN.

NEW MINOR PLANET.—A new minor planet, No. 284, was discovered by M. Charlois, of the Nice Observatory, on May 29.

THE SPECTRUM OF χ CYGNI.—At the Wolsingham Observatory, bright lines were seen in the spectrum of χ Cygni on May 19 and 21; D_3 very plain. Confirmed by Mr. Taylor at Ealing.

ASTRONOMICAL PHENOMENA FOR THE WEEK 1889 *JUNE* 9-15.

(FOR the reckoning of time the civil day, commencing at Greenwich mean midnight, counting the hours on to 24, is here employed.)

At Greenwich on June 9

Sun rises, 3h. 46m.; souths, 11h. 59m. 0·6s.; daily increase of southing, 11·6s.; sets, 20h. 12m.: right asc. on meridian, 5h. 11·2m.; decl. 22° 59′ N. Sidereal Time at Sunset, 13h. 26m.

Moon (Full on June 13, 14h.) rises, 14h. 48m.; souths, 20h. 35m.; sets, 2h. 9m.*: right asc. on meridian, 13h. 48·4m.; decl. 5° 45′ S.

Planet.	Rises.	Souths.	Sets.	Right asc. and declination on meridian.	
	h. m.	h. m.	h. m.	h. m.	° ′
Mercury..	4 52 ...	12 59 ...	21 6 ...	6 11·6 ...	22 6 N.
Venus.....	2 9 ...	9 14 ...	16 19 ...	2 26·1 ...	11 53 N.
Mars......	3 50 ...	12 9 ...	20 28 ...	5 21·3 ...	23 47 N.
Jupiter....	21 18*...	1 13 ...	5 8 ...	18 23·3 ...	23 9 S.
Saturn....	8 28 ...	16 3 ...	23 38 ...	9 15·5 ...	17 7 N.
Uranus...	14 23 ...	19 54 ...	1 25*...	13 7·3 ...	6 28 S.
Neptune..	3 4 ...	10 52 ..	18 40 ...	4 3·7 ...	19 8 N.

* Indicates that the rising is that of the preceding evening and the setting that of the following morning.

June. h.
14 ... 9 ... Jupiter in conjunction with and 0° 29′ south of the Moon.
14 ... 20 ... Mercury at greatest distance from the Sun.

Variable Stars.

Star.	R.A.	Decl.			
	h. m.	° ′		h. m.	
T Cassiopeiæ ...	0 17·2 ...	55 11 N. ...	June 9,		*M*
U Cephei	0 52·5 ...	81 17 N. ...	,, 9,	23 28	*m*
			,, 14,	23 8	*m*
R Geminorum ...	7 0·7 ...	22 53 N. ...	,, 14,		*M*
S Hydræ	8 47·8 ...	3 29 N. ...	,, 12,		*M*
U Hydræ	10 32·1 ...	12 48 S. ...	,, 9,		*m*
W Virginis	13 20·3 ...	2 48 S. ...	,, 10,	3 0	*m*
S Libræ	15 15·0 ...	19 59 S. ...	,, 14,		*m*
U Ophiuchi... ...	17 10·9 ...	1 20 N. ...	,, 12,	0 7	*m*
X Sagittarii... ...	17 40·6 ..	27 47 S. ...	,, 14,	1 0	*m*
Y Sagittarii... ...	18 14·9 ...	18 55 S. ...	,, 14,	2 0	*M*
R Sagittarii... ...	19 10·2 ...	19 30 S. ...	,, 13,		*M*
β Lyræ...	18 46·0 ...	33 14 N. ...	,, 13,	0 0	*M*
η Aquilæ	19 46·8 ...	0 43 N. ...	,, 13,	22 0	*M*
T Vulpeculæ ...	20 46·8 ...	27 50 N. ...	,, 12,	1 0	*m*
δ Cephei	22 25·1 ...	57 51 N. ...	,, 10,	2 0	*m*

M signifies maximum; *m* minimum.

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Meteor-Showers.

	R.A.	Decl.	
	250°	20° S.	
Near ζ Cygni...	318	30 N.	
,, β Piscium	345	0	Very swift.

NOTES ON METEORITES.[1]

IX.

Did these Swarms or Comets always belong to the System?

Must we assume that the members of the swarms to which we have referred and of all the other swarms similar to it have always been thus crossing the earth's orbit periodically; that the November swarm, to take an instance, has *always* been crossing it every thirty-three years? Must they of necessity have started their existence with the planets and other more stable members of the system?

This point has been well inquired into, and it is certain that it is not at all necessary that such a state of things should have existed from all time.

It is a matter of common knowledge that all stars are in motion. The so-called "fixed" stars are not really fixed: they are only relatively fixed. The sun is a star, and therefore like the other stars it is also in movement with its attendant bodies in space.

If we have a swarm of meteorites moving in space, as the sun is doing, at a very considerable distance from the sun, the directions of movement being not parallel but inclined to each other, a time will come when the two bodies, taking the swarm as representing one body, and the sun another, will begin to have an attractive influence on each other. If the attractive energy of the sun is considerable as compared with that of the swarm, the swarm will begin to change its direction obviously towards the sun. If, in changing its direction towards the sun and increasing its velocity in consequence of this increased gravitational stress, that swarm can get round the sun without any loss of momentum the two bodies will say good-bye to each other and will go different ways; but supposing there has been a loss of momentum the loss may mean that for the future the swarm of meteorites must perform its journey *round the sun.*

It does not therefore follow that when a particular group of meteorites has been watched for 900 years that these meteorites which give rise to the appearance of shooting stars always formed part of the solar system. What we do know is that *at the present moment* this particular swarm to which the November meteors are due and another swarm which is called the Biela swarm, to mention two instances, do really move round the sun in closed cometary orbits, and the chronicle of the appearances of both these swarms is so complete that very definite statements may be made about them.

With regard to the November swarm it is known that a thousand millions of miles of its orbit have been pierced by the earth in its successive passages through it since the year 902, each time the earth must have filched many millions of the small constituents of the swarm and used them up as shooting stars, and yet the swarm does not seem to be very much the worse, and enormous though the numbers are, it is known that the distances between the meteorites is so considerable that no obvious mutual gravitational effect can be noted, so that their combined or common movement is a clear indication of a common origin.

In the case of the orbit of the Biela swarm we know that more than half of it, or a length of 500 million miles, contains these meteorites; a long thin line, say a mile long and an inch in section, represents, according to Prof. Newton, the distribution of the meteorites along the orbit.

The great Laplace was the first to suggest that many comets, especially those of high inclination and great eccentricities, represented introductions of matter into the solar system from external space. But on this, as on many other points, we owe our present views chiefly to Schiaparelli, who, in 1867, attacked the problem[1] in connection with his researches on the November swarm.

He commenced by referring to the point made by Laplace as to the phenomena presented by cometary orbits, suggesting that the planets are truly indigenous to the system; have always followed the sun in his movement through space; and had taken part in all the evolutionary changes which have finally brought the solar system to its present condition. In these characters common to planets the comets are lacking, while the eccentricities of their orbits generally is so great that the greater part of their journey is performed outside the known limits of our system. Schiaparelli considers that these facts demonstrate that the comets were not members of the solar system during its early stages, but that they are really messengers from the stellar void. Cloudlike masses wandering in parts of space where there was no star sufficient to dominate them have fallen gradually under the empire of our own by the effect of their movement relatively to our system. This movement, combined with the acceleration produced by the large mass of the sun has determined the relative orbits of these bodies in relation to the sun, which is very different from their absolute orbit in space. He next examined all the circumstances of the movement of the external mass under these conditions. First, there is no doubt that the movement of the solar system in space is comparable to that of the planets in their respective orbits, while it is possible—indeed certain—that many of the stars are in more rapid movement than our sun. Hence when it is affirmed that the relative movement of the sun and of other bodies disseminated through space is comparable in rapidity to the orbital movement of the planets, the statement is not a surprising one.

That being so, let us next suppose that one of these cloudlike masses—let us call them external swarms—wandering in space in consequence of its initial movement, penetrates eventually into a region where the attraction of the sun is much greater than that of any other star. It might be situated at a very great distance from the sun, where the annual parallax is only a small number of seconds. The relative movement will take place in a conic section. To define it, let us suppose the sun stopped, and let us give to the comet, instead of its real velocity in space, its relative velocity to the sun; and let us further imagine a perpendicular dropped from the sun in the direction of this relative velocity. It is evident that the area described by the comet round the sun in unit time will be equal to the half of the product of this perpendicular by its relative velocity.

Now as in general this velocity is of the order of planetary velocities, and since most frequently the perpendicular in question will be very much greater than the distance of the planet from the sun, we must conclude that the areas described by the comet round the sun in unit time will be incomparably greater than the corresponding areas described by the planets. But when many bodies move in conic sections round a central body, the areas described in unit time are, among themselves, as the square roots of the parameters of their respective orbits; therefore, the ratio of the parameters of cometary orbits to those of planetary orbits will be much greater than the ratio of the areas described by comets to the areas described by planets in unit time. Whence it follows that, in general, cometary orbits will have enormous dimensions in every direction, and that bodies which describe them will remain perpetually invisible to us, in consequence of their enormous distance. Nevertheless, among the infinite combinations possible in cometary orbits, there are two which may bring the cometary cloud within our ken: one, when the comet is moving directly towards the sun, describing a hyperbolic orbit very little different from a right line; and the other, when the relative movement of the comet and sun is almost zero, that is, when the two bodies are moving through the stellar space along parallel lines with nearly equal velocities.

Schiaparelli then goes on to show that when these cosmic clouds are attracted by the centre of our system, the constituent particles of the cloud must be drawn out into a parabolic current; thus, for instance, supposing a cosmic cloud equal in volume to the sun and at such a distance that its apparent diameter is 1′, the sun's attraction upon this would result in the formation of a parabolic chain or stream of such a length that it would require 636 years to pass through perihelion. When the centre was close to the sun, the beginning and the end of it would be distant from it 263 times the earth's distance from the

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[1] Continued from vol. xxxix. p. 402.

[1] *Les Mondes*, vol. xiii. p. 147.

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